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A new asellote isopod of the genus *Santia* Sivertsen & Holthuis, 1980 (Crustacea: Isopoda: Asellota: Santiidae) from Japan

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Abstract.—*Santia longisetosa,* a new species of the family Santiidae (Isopoda: Asellota) is described from the Pacific coast of Shikoku, Japan. The new species differs from its congeners in having a long robust sensory seta distal-ventrally on each propodus of pereopods 2–7, the nearly straight frontal margin of the head bearing some long setae, and 2 long robust sensory setae distal-laterally on article 2 of antenna 1.

Santiidae is a small family of four genera and 21 species in the suborder Asellota. *Santia* Sivertsen & Holthuis, 1980, is the largest genus in the family and includes 15 species (Wolff 1989, Wolff & Brandt 2000, Shimomura & Mawatari 2000), all from marine benthic habitats. Among them only one species, *Santia katoi* Shimomura & Mawatari, 2000 has been so far described from Japan. Our recent investigation yielded an undescribed species of *Santia* from the subtidal zone of Kochi Prefecture, Shikoku, the second record of the genus from Japan.

Materials and Methods

Specimens were obtained from 0.5 m depth of the subtidal zone by filtering surface water; specimens were fixed with 5% neutral formalin solution diluted with seawater, and preserved in 70% ethanol. Each isopod was dissected and prepared for observation using a light microscope equipped with Nomarski differential interference contrast (Shimomura & Mawatari 1999). Total length as indicated in "Material examined" was measured from the tip of the head to the end of the pleotelson.

The type specimens are deposited in the Zoological Museum, Division of Biological Sciences, Graduate School of Science, Hokkaido University (ZIHU), and in the Toyama Science Museum (TOYA).

Santia longisetosa, new species
Figs. 1–4

Material examined.—Murotomisaki-cho, Muroto Cape, Kochi Prefecture, Japan, 33°16′N, 134°7′E, 0.5 m, surface water, subtidal, 27 June 2000: holotype, male, 1.0 mm (ZIHU-01963); paratype, ovig. female, 1.1 mm (TOYA Cr-12877); paratypes, 2 females, 1.1 mm (TOYA Cr-12878), 1.3 mm (ZIHU-01966).

Description.—Male: Body (Fig. 1A) about 2.4 times as long as maximum width. Head 2.0 times as broad as long, slightly narrower than pereonite 1, with 10 dorsal setae; frontal margin of head nearly straight, with 8 long setae; labrum surpassing head anteriorly; posterior margin of head convex between eyestalks. Preocular lobes narrow, with 1 or 2 apical setae. Eyes dorsal lateral, each with 3 ommatidia. Pereonites 1–4 laterally rounded, each with 4–7 lateral and few dorsal setae; pereonites 5–7 laterally rounded, each with 0–3 lateral and 2 dorsal setae. Pereonites 1, 2 and 4 subequal in length; pereonite 3 slightly shorter than pereonite 2; pereonites 5 to 7 increasing in length. Pereonites 1 and 2 subequal in width; pereonite 3 slightly wid-

er than pereonite 2; pereonite 4 as broad as pereonite 3; pereonite 5 widest; pereonites 5 to 7 decreasing in width. Coxal plates dorsally visible on pereonites 4–7, laterally rounded, each with 2 or 3 lateral setae. Pleonite short and narrow, without dorsal setae. Pleotelson (Figs. 1A, 2A) about 1.1 times as long as broad, with 13 dorsal, 2 posterolateral, 2 apical, and 12 ventral setae. Uropod (Fig. 2B) stout, directed posteriorly, shorter than pleotelson. Protopod wide posteriorly, about ⅔ as long as exopod, with 1 mesial and 1 lateral robust sensory setae. Exopod and endopod longer than broad. Exopod about 1.5 times as long as protopod, with 1 ventral, 5 dorsal, 2 lateral, 1 subapical and 4 apical robust sensory setae, with 1 apical simple seta; endopod as long as peduncle, with 2 ventral, 1 dorsal, 2 subapical and 2 apical robust sensory setae, with 3 lateral and 2 subapical plumose setae.

Antenna 1 (Fig. 2C) of 6 articles. Article 1 broadest, with 1 distal-lateral and 1 distal-medial setae; article 2 longest, narrower than article 1, with 1 distal-ventral, 1 distal-dorsal and 1 lateral simple setae, with 1 distal-lateral and 1 distal-medial plumose setae, and distal-lateral with 2 long robust sensory setae; article 3 narrow, with 1 distal-ventral and 1 distal-dorsal setae; article 4 slightly shorter than article 3, without setae; article 5 about 1.7 times as long as article 4, apically with 1 aesthetasc; article 6 narrow and short, apically bearing 1 aesthetasc and 2 short, 1 long setae.

Antenna 2 (Fig. 2E) composed of 6 stout articles and 12 thin flagellar articles. Article 1 with 1 distal-lateral seta; article 2 as broad as article 1, without setae; article 3 longer than article 2, with 3 distal-ventral, 1 dorsal and 1 distal-medial setae; article 4 shorter than article 3, with 2 distal-ventral, 3 distal-lateral and 1 medial setae; article 5 as long as article 6, with 2 ventral, 3 dorsal, 2 lateral and 3 mesial simple setae, and with 1 long robust sensory seta distal-medially and 1 plumose seta laterally; article 6 narrower than article 5, bearing 3 ventral, 4 dorsal, 2 lateral and 2 medial simple setae, and with 1 lateral and 1 medial plumose setae. Flagellum about 2.6 times as long as article 6, each with many setae.

Left mandible (Fig. 2F) lacking palp, bearing 1 short seta arising from its base; incisor with 4 cusps; lacinia mobilis with 3 teeth; setal row with 4 setae; molar process stout, bearing 2 apical setae. Right mandible (Fig. 2G) lacking palp and lacinia mobilis, bearing 1 short seta arising from its base; incisor with 6 cusps; setal row with 4 setae; molar process stout, bearing 2 apical setae.

Maxilla 1 (Fig. 2H) with inner lobe bearing 4 apical setae; outer lobe apically with 5 pectinate setae and 5 simple setae, dorsally with many short setae. Maxilla 2 (Fig. 2I) with inner lobe with 5 apical setae and many dorsal setae; outer 2 lobes each with 4 apical setae.

Maxilliped (Fig. 3A) with moderately broad palp composed of 5 articles; article 1 as broad as article 2, with 1 medial seta; article 2 trapezoidal, about 2.3 times as long as article 1, with 1 lateral and 2 medial setae; article 3 as long as article 2, with 2 lateral and 3 medial setae; article 4 slightly shorter than article 3, with 2 lateral and 4 medial setae; article 5 narrowest, with 1 subapical and 2 apical setae; endite quadrate, bearing 4 dorsal, 6 distal simple setae, with 5 distal pectinate setae and 3 subdistal fan-shaped setae, and with many short setae laterally and 2 coupling hooks medially, epipod lanceolate, moderately broad, narrower than endite, with rounded apex.

Pereopod 1 (Fig. 3B) shorter than pereopods 2–7: basis the longest article, with 2 ventral, 2 dorsal and 1 lateral setae; ischium narrower than basis, bearing 1 ventral, 2 dorsal, 1 lateral and 2 distal setae; merus trapezoidal, with 1 ventral, 3 distal-ventral and 2 distal-dorsal simple setae, with 1 long robust sensory seta distal-dorsally; carpus trapezoidal, broadest, ventrally with 2 long robust sensory setae and 3 simple setae, medially with 1 simple seta and 3 spinulose scales, and with 1 simple seta distal-dorsal-

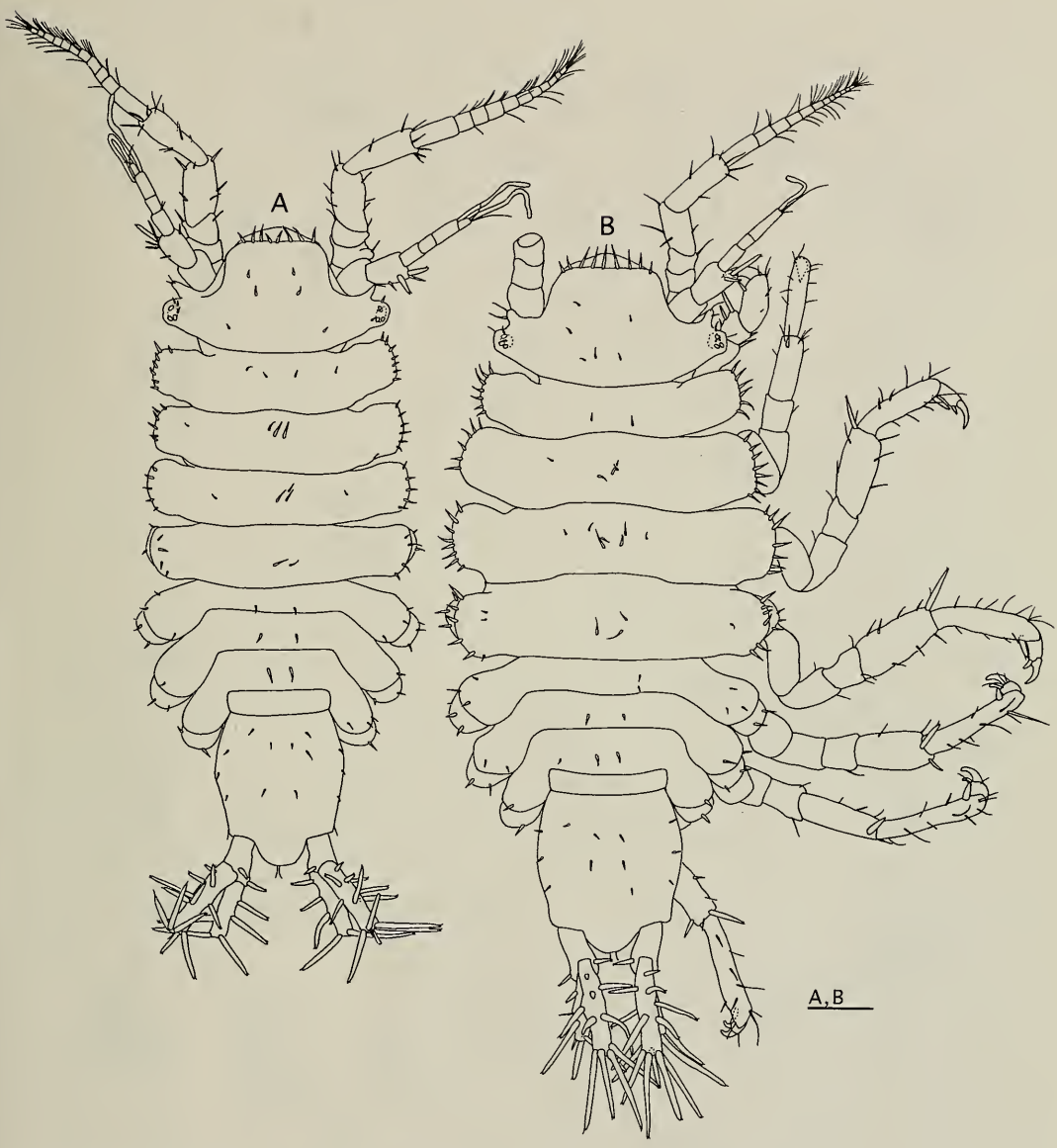

Fig. 1. *Santia longisetosa,* new species. A, holotype male, dorsal; B, paratype female (TOYA Cr-12877), dorsal. Scales = 0.1 mm.

ly; propodus ovate, ventrally with 5 simple setae and 1 robust sensory setae, medially with 1 simple short seta and 7 spinulose scales, and with 5 simple setae dorsally; dactylus shorter than propodus, narrowest of all articles, with 2 distolateral and 3 medially setae, 1 curved unguis, and 1 short accessory spine.

Pereopod 2 (Fig. 3C) as long as pereopod 4: basis with 2 ventral, 2 dorsal and 1 lateral setae; ischium shorter than basis, with 2 ventral, 2 dorsal and 2 medially setae; merus trapezoidal, distal-dorsally with 2 simple and 1 long robust sensory setae, with 2 ventral, 1 distal-lateral and 1 distal-medial simple setae; carpus longer than basis, dorsally with 4 simple, 1 robust sensory and 1 plumose setae, with 3 ventral, 2 lat-

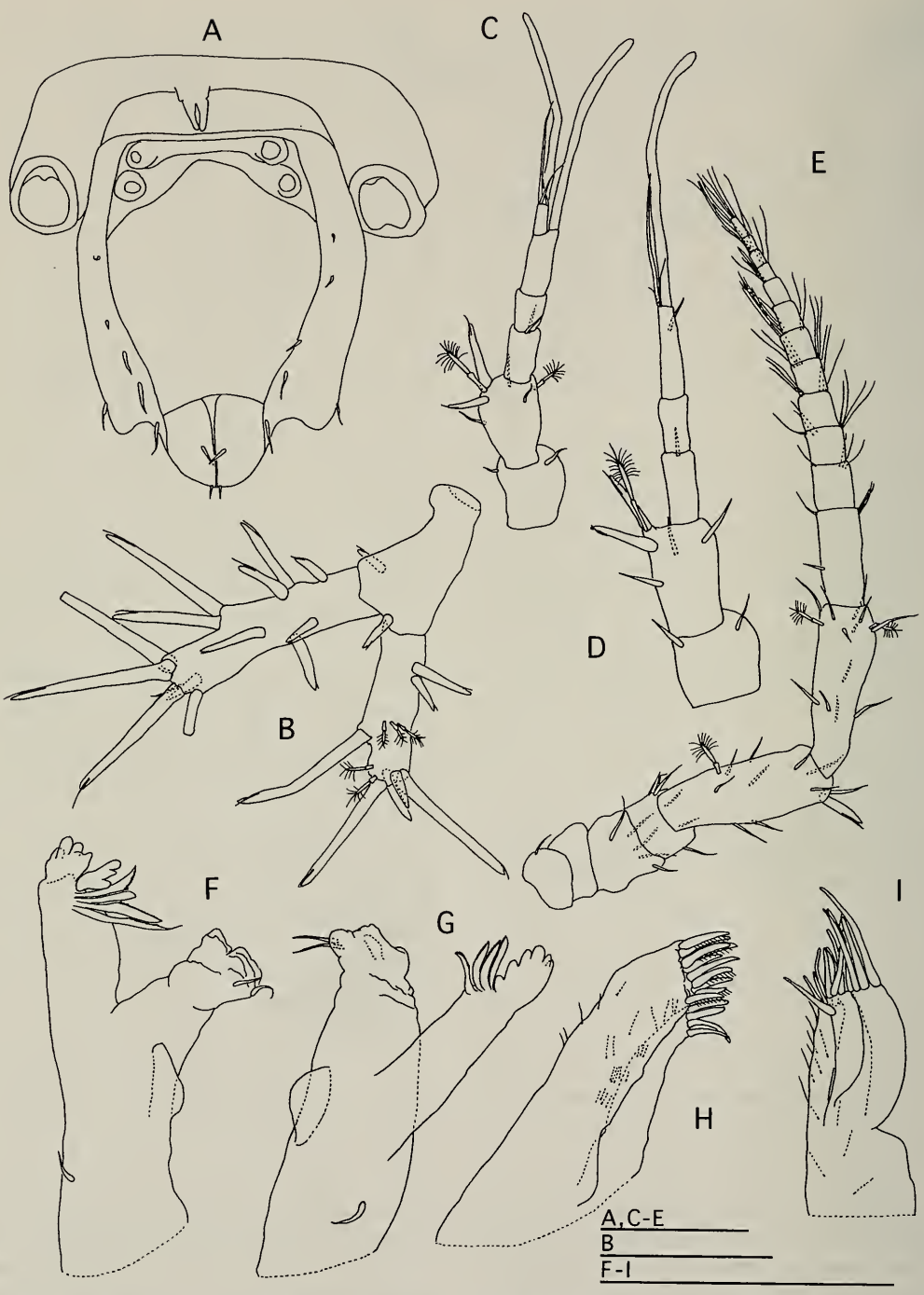

Fig. 2. *Santia longisetosa,* new species. A-C, E-I, holotype male; D, paratype female (ZIHU-01966): A, pereonite 7 and pleon, ventral; B, right uropod, ventral; C, left antenna 1, dorsal; D, left antenna 1, dorsal; E, left antenna 2, dorsal; F, left mandible, dorsal; G, right mandible, dorsal; H, right maxilla 1, ventral; left maxilla 2, ventral. Scales = 0.1 mm.

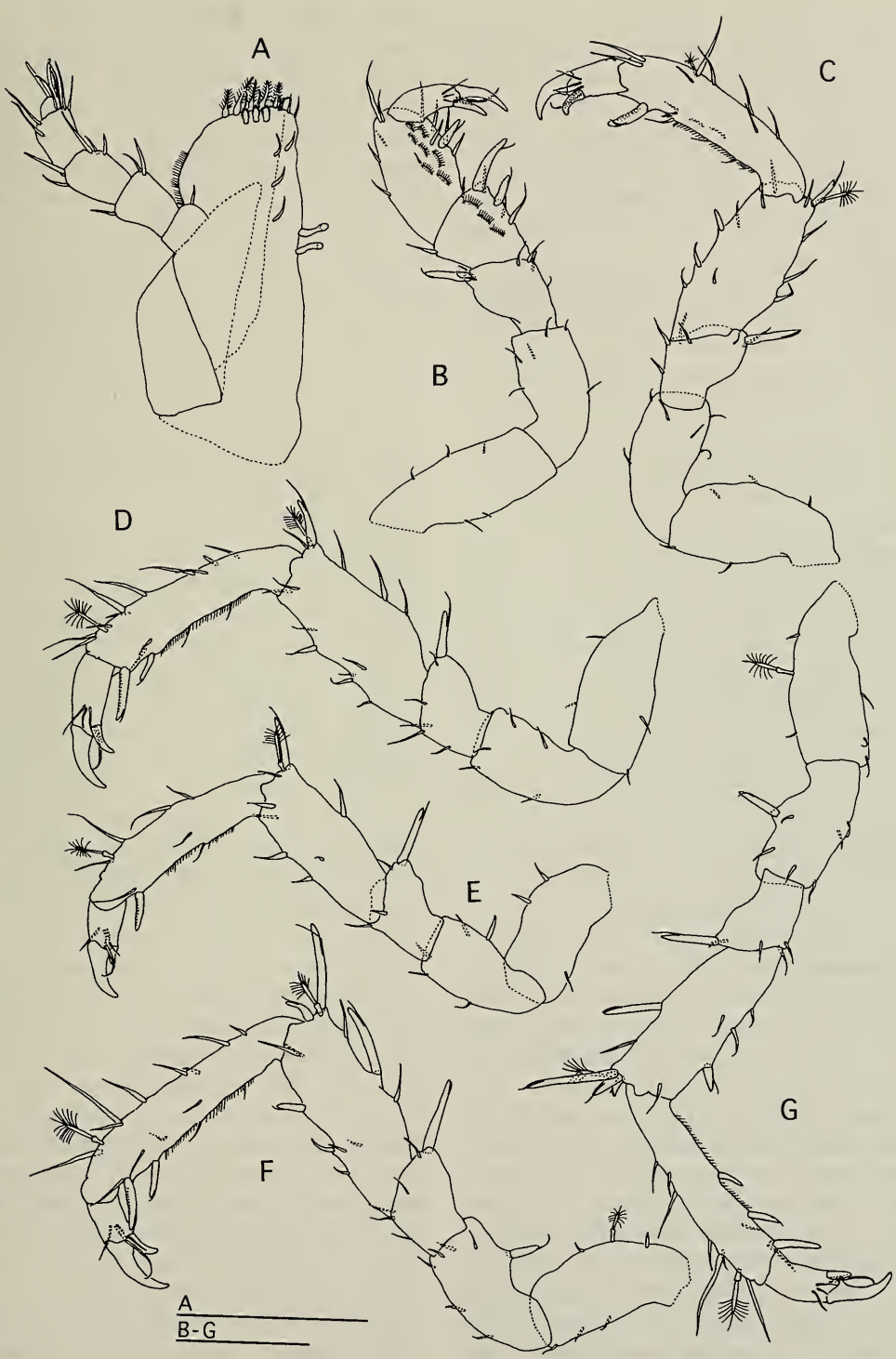

Fig. 3. *Santia longisetosa,* new species. A-G, holotype male: A, left maxilliped, dorsal; B, left pereopod 1, mesial; C, right pereopod 2, mesial; D, right pereopod 3, mesial; E, left pereopod 4, lateral; F, left pereopod 5, lateral; G, right pereopod 6, mesial. Scales = 0.1 mm.

eral and 2 medial simple setae; propodus the longest article, dorsally with 5 simple and 1 plumose setae, with 3 ventral, 3 lateral, 4 mesial simple setae, and with 1 distal-ventrally long robust sensory seta and many ventral short setae; dactylus the narrowest article; with 2 distal-lateral and 3 medial setae, 1 curved unguis, and 1 minute accessory spine.

Pereopod 3 (Fig. 3D) slightly longer than pereopod 2: basis with 2 ventral and 2 dorsal setae; ischium with 2 ventral, 2 dorsal and 1 distal-medial setae; merus distal-dorsally with 1 simple and 1 long robust sensory setae, with 2 ventral, 1 distal-medial and 1 distal-lateral simple setae; carpus dorsally with 4 simple, 1 robust sensory and 1 plumose setae, with 4 ventral, 2 lateral and 2 mesial simple setae; propodus dorsally with 10 simple and 1 plumose setae, with 2 ventral, 1 lateral, 1 mesial simple setae, and with 1 ventral-distal long robust sensory, 1 ventral short robust sensory setae and many ventral short setae; dactylus with 2 distal-lateral and 3 medial setae, 1 curved unguis, and 1 minute accessory spine.

Pereopod 4 (Fig. 3E) slightly shorter than pereopod 3: basis with 1 ventral and 2 dorsal setae; ischium with 2 ventral, 2 dorsal and 1 distal-medial setae; merus distal-dorsal with 1 simple and 1 long robust sensory setae, with 1 distal-ventral and 1 distal-lateral simple setae; carpus dorsally with 1 simple, 1 long robust sensory and 1 plumose setae, with 2 ventral, 3 lateral and 1 mesial simple setae; propodus dorsally with 4 simple and 1 plumose setae, with 2 ventral and 1 lateral simple setae, and with 1 distal-ventral long robust sensory seta and many ventral short setae; dactylus with 2 distal-lateral and 3 medial setae, 1 curved unguis, and 1 minute accessory spine.

Pereopod 5 (Fig. 3F) longer than pereopod 3: basis dorsally with 2 simple and 1 plumose setae, with 3 ventral simple setae; ischium with 1 dorsal robust sensory seta and 3 ventral, 2 lateral and 1 distal-medial simple setae; merus distal-dorsal with 1 simple and 1 long robust sensory setae, with 2 ventral, 1 distal-medial and 1 distal-lateral simple setae; carpus dorsally with 2 simple, 2 long robust sensory, 1 short robust sensory and 1 plumose setae, with 1 ventral robust sensory seta and 2 ventral, 2 lateral and 2 medial simple setae; propodus dorsally with 7 simple and 1 plumose setae, with 3 ventral, 3 lateral, 2 medial simple setae, and with 1 distal-ventral long robust sensory, 1 ventral short robust sensory setae and many ventral short setae; dactylus with 2 distal-lateral and 3 medial setae, 1 curved unguis, and 1 minute accessory spine.

Pereopod 6 (Fig. 3F) the longest pereopod: basis dorsally with 2 simple and 1 plumose setae, with 3 ventral simple setae; ischium with 1 dorsal robust sensory seta and 3 ventral, 3 medial simple setae; merus distal-dorsal with 1 simple and 1 long robust sensory setae, with 2 ventral and 1 distal-medial simple setae; carpus dorsally with 1 simple, 2 long robust sensory, 2 short robust sensory setae and 1 plumose setae, with 2 ventral robust sensory setae and 2 ventral, 2 medial simple setae; propodus dorsally with 7 simple and 1 plumose setae, with 1 distal-ventral and 1 lateral simple setae, and with 1 distal-ventral long robust sensory, 2 ventral short robust sensory setae and many ventral short setae; dactylus with 2 distal-lateral and 3 medial setae, 1 curved unguis, and 1 minute accessory spine.

Pereopod 7 (Fig. 4A) slightly shorter than pereopod 6: basis dorsally with 1 simple and 2 plumose setae, with 2 ventral simple setae; ischium with 1 dorsal robust sensory seta and 2 ventral, 2 dorsal and 1 distal-lateral simple setae; merus distal-dorsal with 1 simple and 1 long robust sensory setae, with 1 distal-ventral, 1 distal-medial and 1 distal-lateral simple setae; carpus dorsally with 1 simple, 1 long robust sensory, 2 short robust sensory setae and 1 plumose setae, with 1 short ventral robust sensory, 1 distal-lateral short robust sensory setae, and with 2 ventral, 1 lateral and 2 medial simple setae; propodus, dorsally with 7 simple and 1 plumose setae, with 1 distal-ventral, 2 lateral simple setae, and with 1 distal-ventral

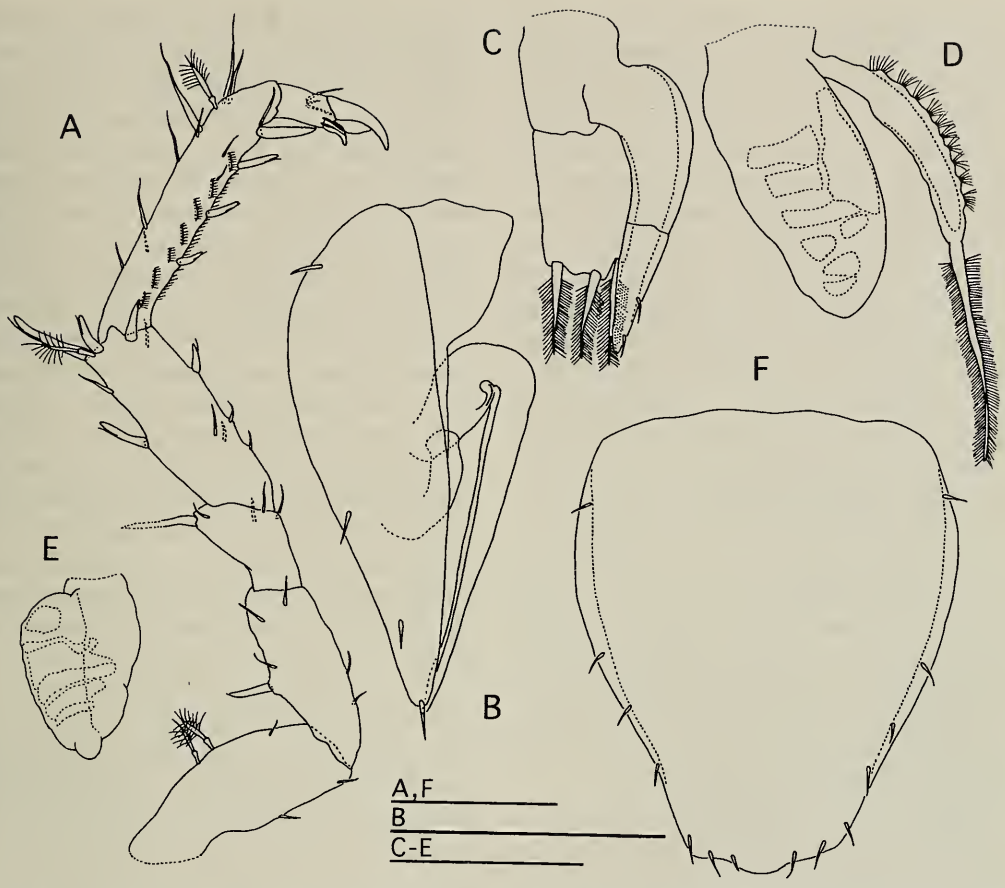

Fig. 4. *Santia longisetosa,* new species. A-E, holotype male; F, paratype female (ZIHU-01966): A, right pereopod 7, lateral; B, left pereopod 2, ventral; C, left pleopod 3, ventral; D, right pleopod 4, dorsal; E, left pleopod 5, dorsal; F, operculum, ventral. Scales = 0.1 mm.

long robust sensory, 3 distal-ventral short robust sensory setae, many ventral short setae and 7 lateral spinulose scales; dactylus with 2 distal-lateral and 3 medial setae, 1 curved unguis, and 1 minute accessory spine.

Pleopod 1 broken. Pleopod 2 (Fig. 4B) with broad protopod, tapering to rounded apex, lateral margin convex, bearing 1 apical and 3 submarginal setae; endopod with slender second article; exopod narrow. Pleopod 3 (Fig. 4C) with endopod bearing 3 stout, plumose setae distally; exopod composed of 2 articles, narrower than endopod; article 2 bearing 2 lateral simple setae. Pleopod 4 (Fig. 4D) with exopod narrow, distally with 1 stout, long plumose seta, laterally with many short setae; endopod ovate and broad, without setae. Pleopod 5 (Fig. 4E) ovate, uniramous, about 1.6 times as long as broad, without setae.

Female: Similar to male in morphology of all pereonal appendages. Body (Fig. 1B) about 2.1 times as long as maximum width. Head slightly narrower than pereonite 1, with 10 dorsal setae; frontal margin of head nearly straight, with 9 long setae. Pereonites 1–4 laterally rounded, each with 6–8 lateral setae and few dorsal setae; pereonites 5–7 laterally rounded, each with 1–3 lateral setae and few dorsal setae. Pereonite 1 shorter than pereonite 2; pereonites 2 and 3 subequal in length; pereonite 4 longest; pereonites 5 and 6 subequal in length; pereon-

ite 7 longer than pereonite 6. Pereonites 1 to 3 increasing in width; pereonite 3 widest; pereonite 4 slightly narrower than pereonite 3; pereonites 5 to 7 decreasing in width. Coxal plates dorsally visible on pereonites 4–7, each with 1–3 lateral setae. Pleonite short and narrow, without dorsal setae. Antenna 1 (Fig. 2D) composed of 5 articles. Article 1 broadest, with 1 distal-lateral and 1 distal-medial setae; article 2 longest, narrower than article 1, with 1 distal-ventral, 1 lateral and 1 distal-medial simple setae, with 1 distal-lateral plumose seta, and with 2 distal-lateral robust sensory setae; article 3 narrow, with 1 distal-ventral seta; article 4 slightly shorter than article 3, without setae; article 5 about 1.6 times as long as article 4, subapically with 1 short setae, apically with 1 aesthetasc and 2 short, 1 long setae. Operculum (Fig. 4F) about 1.2 times as long as broad, apically with short rounded projection, submarginally with 14 setae.

Etymology.—The specific name refers to the long sensory setae on the antenna 1 and on the propodi of the pereopods 2–7.

Remarks.—The present new species is assigned to Santiidae Kussakin, 1988, having a set of the following characters: eyes situated on lateral processes, short antenna 1 having 5 or 6 articles, antenna 2 with 4 short proximal, 2 long distal articles and flagellum, subcylindrical truncate mandibular molar process, narrow maxillipedal palp, distally pointed epipod of maxilliped, coxal plates of pereonites 5–7 visible dorsally, prehensile pereopod 1 and ambulatory pereopods 2–7, uropods situated on posterolateral margin of pleotelson, and terminally exposed anus. The following features displayed by the present new species indicate that it belongs to *Santia* Sivertsen & Holthuis, 1980: antenna 1 and 2 in anterior indentations laterally on the head, preocular lobes in front of the eyestalks, pleotelson apically with short rounded projection, pereopod 1 armed with 1 unguis and 1 accessory spine, female operculum longer than broad, and uropods with stout protopod, cylindrical endopod and exopod.

Santia longisetosa is distinguishable from its congeners by 2 long robust sensory setae on article 2 of antenna 1 and 1 long robust sensory seta ventrodistally on each propodus of pereopods 2–7. The nearly straight frontal margin of head and the robust long uropods are shared by *Santia longisetosa, S. milleri* (Menzies & Glynn, 1968) from Caribbean Sea (type locality), *S. hispida* (Vanhöffen, 1914) from St. Paul Island, the southern Indian Ocean (type locality), Tristan da Cunha (Nordenstam 1933) and the Magellan Strait (Winkler 1993). The present new species is distinguished from *S. milleri* by the following features (those of *S. milleri* in parentheses): article 2 of antenna 1 has 2 long robust sensory setae, propodi of pereopods 2–7 have a long robust sensory seta distal-ventral, pereonite 1 is slightly wider than head (narrower than head), coxal plates lack anterior-lateral stout setae (each with anterior-lateral stout seta), mandibular palp is absent (present), maxillipedal palp is moderately broad (narrow). *Santia hispida* differs from the present new species in having the narrow maxillipedal palp, the mandibular palp, many long stout dorsal and lateral setae on head, pereon and pleon, very long second article of pleopod 1 in male, and a pair of stout setae on operculum in female.

Santia charcoti (Richardson, 1906) (Hodgson 1910, Wilson 1980) from the Antarctic has stout uropods, similar to those of *S. longisetosa.* The present new species is however distinguished from the *S. charcoti* by the following features (those of *S. longisetosa* in parentheses): the frontal margin of head is bilobed (unilobed), many long setae are on head, pereon and pleon (some short setae), the pleotelson is short (long), endopod of uropod is curved (straight), protopod of pleopod 1 in male is broad (narrow), and coxal plates of pereonite 7 are dorsally invisible (visible).

The present new species differs from another Japanese species, *S. katoi* Shimomura & Mawatari, 2000 described from Shirahama coast, Wakayama Prefecture in the

following features (those of *S. katoi* in parentheses): the mandible lacks palp (palp present), the frontal margin of head is nearly straight (slightly convex), with 8 or 9 long setae (4 short setae), the head is narrower than pereopod 1 (broader than pereopod 1), the uropod shorter than pleotelson (longer than pleotelson), the article 2 of antenna 1 has 2 long robust sensory setae distolaterally (without sensory setae), and the propodi of pereopods 2–7 are armed with long robust sensory setae ventrodistally (with short robust sensory setae).

The present new species shows a variation in segmentation of antenna 1 as follows: holotype male has 6-articulate antenna 1 consisting of 2 stout, 2 short, 1 long and 1 minute articles, while all paratype females have 5-articulate antenna 1 consisting of 2 stout, 2 short and 1 long articles.

Acknowledgments

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